



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/821,371	04/09/2004	Anders Landin	5181-25901	1212
58467	7590	02/05/2008		
MHKKG/SUN P.O. BOX 398 AUSTIN, TX 78767			EXAMINER PATEL, KAUSHIKKUMAR M	
			ART UNIT 2188	PAPER NUMBER
			MAIL DATE 02/05/2008	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<p align="center"><b>Office Action Summary</b></p>	<p>Application No. 10/821,371</p>	<p>Applicant(s) LANDIN ET AL.</p>	
	<p>Examiner Kaushikkumar Patel</p>	<p>Art Unit 2188</p>	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 September 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 7-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 7-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

1. This Office Action is in response to applicant's communication filed September 13, 2007 in response to PTO Office Action mailed June 13, 2007. The applicant's remarks and amendments to the claims and/or specification were considered with the results that follow.
2. In response to last Office Action, claims 7, 13, 18 and 22 have been amended. Claims 1-6 have been previously canceled. Claim 30 has been currently canceled. No claims have been added. As a result, claims 7-29 remain pending in this application.

### ***Response to Arguments***

3. Applicant's arguments filed September 13, 2007 with respect to claims 7, 18 and 22 have been fully considered but they are not persuasive.

Applicant largely argues that Rowlands-1 (US 6,948,035) teaches a transaction using bus system by mentioning Rowlands-1's teaching from fig. 3 and fig. 7 (remarks, pages 9-10). Examiner agrees with the applicant's assertion that Rowland teaches transactions, however it automatically does not mean a bus system. Rowlands-1 teaches that in some embodiments the interface may defined as packet interfaces (Rowlands-1, col. 5, line15) and packet interfaces may carry packet data directly or indirectly (e.g. transmitting the packet data as a payload or a command (Rowlands-1, col. 5, lines 36-43). Rowlands-1 further teaches that a "packet" may include any communication between a source node and a destination node which includes one of

more headers defining the source and the destination of the packet at various levels (col. 8, lines 3-13). Also, according definition of transaction as taught by Keller (US 7,296,122): "Generally speaking, a "packet" is a communication between two processing nodes. One or more packets may form a "transaction", which is a transfer of information from one processing node to another. The packets forming a transaction from a source node to a target node, packets transmitted between other processing nodes to maintain coherency, data packets and acknowledgment packets which terminate the transaction" (Keller, col. 5, lines 21-31). From above discussion it is apparently clear that Rowlands-1 teaches transactions, but transactions can be packetized information and thus applicant's interpretation of bus based system is not valid and not persuasive because Rowlands-1 teaches a transaction based system but he also teaches sending packets in entire disclosure.

Applicant further argues that the Examiner's interpretation of "probe" packets as proxy address packets is not equivalent because typically a probe command gets sent by a requesting processor to all other entities in a system (remarks, page 10). Here applicant's interpretation of typical probe packet may be true, but Rowlands-1 defines probe packets as "the memory bridge 32 may issue one or more coherency commands to the other nodes to obtain the ownership" (col. 5, lines 53-55), "the memory bridge 32 may receive coherency commands from other nodes, and may perform transactions on the interconnect 22 to effect the coherency commands" (col. 5, lines 59-62), "the memory bridge 32 in the remote node may generate and transmit the coherency command to the home node to obtain the copy or to obtain sufficient ownership. The

Art Unit: 2188

memory bridge 32 in the home node may determine if any state changes in other nodes are to be performed to grant the requested ownership to the remote node, and may transmit coherency commands (e.g. probe commands) to effect the state changes" (col. 6, lines 15-28). Here it is apparently clear that memory bridges in the nodes receives and transmits the coherency messages and also sends probe commands in response to received coherency messages to effect the state changes and to provide a data to requesting node, performing the same function as proxy commands of the applicant. It is also understood from fig. 2 that the memory bridge acts as interface between nodes. Thus, it is entirely clear that Rowlands-1 teaches an interface sending proxy packets (probe) in response to received coherency message to effect the required state changes and to fill the data to requester.

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 7-15 and 18-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rowlands et al. (US 6,948,035) (Rowlands-1), Rowlands et al. (US 2004/0034747) (Rowlands-2) and Chen et al. (US 6,931,496).

As per claims 7, 18 and 22, Rowlands-1 teaches a multi-node system, (figs. 1-3), comprising:

A node including a plurality of active devices and an interface coupled by an address network configured to convey address packets between the interface and the plurality of active devices and a data network configured to convey data packets between the interface and plurality of active devices, wherein the address network and the data network are separate networks (Rowlands-1, fig. 1, items 12A – 12N, col. 12, lines 19-25, col. 8, lines 3-13, it is noted here that Rowlands-1 discusses sending receiving packets throughout the disclosure and he also teaches use of separate address and data bus which can be interpreted as address and data networks);

an inter-node network configured to convey coherency messages between the interface in the node and an additional interface in an additional node (Rowlands-1, fig. 1, fig. 2, col. 8, lines 65-67, col. 9, lines 25-47, col. 10, lines 53-65), wherein the additional interface is configured to send a coherency message requesting a read access right to a coherency unit on the inter-node network (Rowlands-1, col. 3, lines 15-67, col. 5, lines 53-55, col. 9, lines 3-46), wherein a given active device of the plurality of active devices has an ownership responsibility for the coherency unit (Rowlands-1, col. 10, lines 40-47, the agent with exclusive ownership);

wherein the interface is configured to respond to the coherency message by sending a proxy address packet on the address network (Rowlands-1, col. 10, lines 6-35, col. 19, lines 24-33, probe commands);

wherein a different active device of the plurality of active devices is configured to request a read access right to another coherency unit by sending an address packet on the address network (Rowlands-1 does not explicitly describe this, but the system of

Rowlands-1 as described in figs. 1-3, with multiple nodes with multiple active devices (i.e. processors, memory and I/O bridge (agents)) communicates with each other and share data to each other inherently requires any active device in any node can be capable requesting a read access right to any coherency unit, Rowlands-1, col. 10, line 53 – col. 11, line 9, illustrates one example).

Rowlands-1 fails to explicitly teach given active device with ownership responsibility of the coherency unit and another coherency unit (i.e. two different units) and another active device from same node is requesting read access to one of the coherency unit and a different active device from another (remote) node requests second of the coherency unit, but the system with multiple node (such as of Rowlands-1's system) including plurality of active devices in each node can own multiple coherency units and any of the active device can request read access to any coherency units thus satisfying the limitations, given active device with ownership responsibility and read access request for coherency units. However, Rowlands-1 fails to teach transitioning ownership, when active device from remote node requests a read access right to coherency unit. Rowlands-2, teaches two-tiers of coherency mechanism in multi-node system (Rowlands-2, par. [0022], intra-node as MESI protocols and inter-node as MSI protocols), and further teaches that a remote node can acquire cache line (coherency unit) in shared state or in modified state (i.e. exclusive ownership) and in modified state the node can give an exclusive ownership to a single agent (Rowlands-2, pars. [0069] – [0071]). As per well-known MSI (i.e. modified, shared, invalid) protocols, when data requires in shared state, the active device (or node) with modified state (i.e.

exclusive ownership) must write back data to memory and transition to shared state, this satisfies the limitation, "when active device from another node requests read access to coherency unit from owner (agent within the node with inter-node state as modified state), the owner (agent or active device), owning device writes back the cache line and transitions state (global state) from modified to shared and hence the ownership of the coherency unit". It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize two-tier coherency protocol as taught by Rowlands-2 in the system of Rowlands-1 to reduce the bandwidth requirement of the system (Rowlands-2, par. [0025]). Rowlands-1 and Rowlands-2 however combined fail to teach not transitioning ownership for intra-node active device read request. Chen teaches sharing modified cache line within the node, i.e. active device with modified cache line (exclusive owner of the line) can share the line to other active device within the node (Chen, col. 3, lines 54-67). It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize teaching of Chen in the system of Rowlands-1 and Rowlands-2, because by sharing modified data without gaining exclusive ownership of data reduces network traffic (Chen, col. 2, lines 52-63).

As per claims 8-9 and 23-24, Rowlands-1 and Rowlands-2 teach a multi-node system with plurality of active devices (Rowlands-1, figs. 1-3, Rowlands-2, figs. 8-11) and interfaces are able send and receive address packets (Rowlands-1, col. 8, lines 65-67, col. 9, lines 25-47, col. 10, lines 53-65, Rowlands-2, par. [0072]), which inherently teaches active devices within the inter-node system request access rights (read/write) to



any coherency unit from any other active device in any node, and subsequently send address packets, thus satisfying limitations of claims.

As per claims 10-13, 19-20 and 25-28 Rowlands-1 and Rowlands-2 teach multi-node system as explained with respect to claims 7-9 above, wherein when a device requests read access right to cache line, the owner sends data to requester and memory bridge (Rowlands-1, col. 7, lines 30-35) issues a probe commands (proxy) or node controller (Rowlands-2, par. [0072]) issues probe commands (proxy) to gain ownership, thus the requester gains the read access right at the end of the transaction and sending address packets is inherent in the system.

As per claims 14, 21 and 29, Rowlands-1 teaches exemplary RdShd and cRdShd commands (Rowlands-1, col. 19, 24-35), which is equivalent to read-to-share and proxy-read-to-share commands.

As per claim 15, Rowlands-2 teaches two-tier coherency as explained with respect to claim 7 above and further teaches that the ownership is maintained according to both protocols in combination (Rowlands-2, pars. [0068] – [0069]). Rowlands-2 also teaches that when node borrows cache line in shared state (i.e. inter-node shared), no modification is allowed (i.e. no exclusive ownership), which inherently means, when the inter-node global state is shared, no node has exclusive ownership of the cache line.

6. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rowlands et al. (US 6,948,035) (Rowlands-1), Rowlands et al. (US 2004/0034747)

(Rowlands-2) and Chen et al. (US 6,931,496) as applied to claim 7 above, and further in view of Hagersten et al. (US 5,940,860).

As per claim 16, Rowlands-1, Rowlands-2 and Chen combined fail to teach the limitation of claims 16-17, but Hagersten teaches when global state of node is modified (i.e. gM), internal bus entity (active device) has an exclusive copy of the cache line (Hagersten, col. 11, lines 1-2) and there can be no valid copy of same memory block existing anywhere in the system (Hagersten, col. 7, lines 34-40). It would have been obvious to one having ordinary skill in the art at the time of the invention to utilize teaching of Hagersten in the system of Rowlands-1, Rowlands-2 and Chen to maintain efficient coherency of the system.

Claim 17 is rejected under same rationales as applied to claim 15 above.

### ***Conclusion***

7. The examiner also requests, in response to this Office action, support be shown for language added to any original claims on amendment and any new claims. That is, indicate support for newly added claim language by specifically pointing to page(s) and line no(s) in the specification and/or drawing figure(s). This will assist the examiner in prosecuting the application.

8. When responding to this office action, Applicant is advised to clearly point out the patentable novelty which he or she thinks the claims present, in view of the state of the art disclosed by the references cited or the objections made. He or she must also show how the amendments avoid such references or objections See 37 CFR 1.111(c).

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaushikkumar Patel whose telephone number is 571-272-5536. The examiner can normally be reached on 8.00 am - 4.30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hyung Sough can be reached on 571-272-6799. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2188

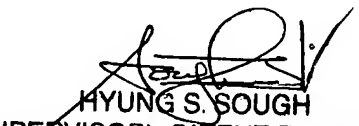
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



kmp

February 1, 2008

Kaushikkumar Patel  
Examiner  
Art Unit 2188



HYUNG S. SOUGH  
SUPERVISORY PATENT EXAMINER

02/01/08